

RESPONSE AND REQUEST FOR RECONSIDERATION

Response.

The claims, as amended, now require that component (a) is a vinyl arene monomer. Other types of olefin monomers containing a cyclic structure are no longer included as this required component (a), although they may still be incidentally present as a result of the “comprising” language of the claim. Likewise, component (b) is now a branched non-cyclic olefin monomer. Linear non-cyclic olefin monomers are no longer included as this required component (b), although again they may still be incidentally present as a result of the “comprising” language of the claim. No other elements or aspects of claim 1 have been amended. Claim 22 is similarly amended. Amendments to the dependent claims are introduced to conform them to the language of claim 1, and no additional substantive limitations are introduced.

The examiner had indicated that claim 1 and certain of the other claims were anticipated by Chen et al., U.S. Patent 4,922,047. Chen discloses production of traction fluids from bicyclic and monocyclic terpenes, which may be copolymerized with a light olefin such as propylene or butylene (e.g., beta-pinene plus isobutylene in example 4) and hydrogenated.

The present claims are distinguished from the teaching of Chen on several counts. First, component (a) is required to be a vinyl arene monomer. There is no disclosure in Chen of the use of a vinyl arene – only cyclic terpenes. Secondly, the monomer of component (b) must be branched and non-cyclic and, if monounsaturated, must contain at least 5 carbon atoms. There is no disclosures in Chen of the use of such a monomer (propylene and butylene have only 3 or 4 carbon atoms, and propylene, in any event, is non-branched.).

As to the distinction between vinyl arenes and cyclic terpenes, it is acknowledged that certain terpenes may have a superficially similar skeletal structure to certain vinyl arenes, ignoring the aromatic bonding of the arenes. However, they are in fact different, and these differences lead to structural differences in the resulting oligomer. First, there exist a wide variety of terpenes, most of which are bicyclic materials that do not have even any gross structural similarity to the vinyl arene monomers of (a) (nor to the branched, non-cyclic monomers of (b), for that matter). And even the few monocyclic terpenes, such as the pinenes or limonene mentioned in Chen, are significantly different than vinyl arenes. When vinyl arenes are employed, as in the present invention, only the vinyl group can be involved in the polymerisation. On the other hand, for cyclic terpenes having an interior and an exterior double bond, both double bonds will

be involved in the reaction, at least to a certain extent. Moreover, subjecting of terpenes to cationic (protonic) reaction conditions can additionally lead to rearrangements and double bond migrations within the molecules. Plainly, terpenes react differently than vinyl aromatic monomers, leading to structurally different products with necessarily different properties.

An additional difference in the reactivities of these materials is their ease of hydrogenation. The materials of the present invention are “substantially completely hydrogenated” addition products of vinyl aromatic monomers. Complete or substantially complete reduction of the aromatic rings deriving from the vinyl aromatic monomers is well known to be significantly more difficult than the reduction of the simple residual olefinic unsaturation of the non-aromatic product of a terpene. Chen merely discloses hydrogenation suitable to saturate the olefinic or aliphatic unsaturation of the product (col. 7 lines 60-66), which may be done by “mild hydrogenation” using Ni catalyst and 500 psig hydrogen pressure at 350-375 °F (col. 8 lines 35-42) or, in practice, 450 °F (232 °C) at only 40-45 psig hydrogen (examples 3 and 5). These conditions would be insufficient for substantially complete hydrogenation of aromatic rings. (Compare “severe hydrogenation” at 3000+ p.s.i. and 220°C (428°F) over Raney nickel as disclosed in Duling, U.S. 3,608,375, col. 17 line 56 and col. 26 line 25.)

The Examiner had pointed out that Chen also mentions a traction fluid made by catalytic polymerization of styrene. This is found in the background discussion, in column 2, relating to some of the background art, in particular, Duling et al., US 3,608,385, referred to above. Styrene or substituted styrenes, however, are never disclosed or suggested as a part of Chen’s invention. And looking more closely at the description of Duling in col. 2, Chen describes the traction fluid as “made by the catalytic polymerization of styrene, alpha-methyl styrene, beta-methyl styrene, or by the catalytic polymerization of propylene or butylene” [emphasis added]. Duling never teaches or suggests a copolymerization product of a vinyl aromatic together with propylene or butylene. This may be confirmed by reviewing the Duling patent itself, which is now made of record in the accompanying supplemental information disclosure statement.

Accordingly, there would be no motivation to arrive at the present invention starting from the disclosure of Chen. To attempt to do so, one would need to replace the cyclic terpenes with a vinyl aromatic compound, replace the propylene or butene monomer with a branched non-cyclic olefin of at least 5 carbon atoms (for monounsaturated olefins), and apply much more severe hydrogenation conditions to the reaction

product. Therefore, it is submitted that both composition claim 1 and method claim 22 are novel and unobvious.

The dependent claims, being necessarily narrower, are also novel and unobvious. However, additional specific comments will be made with regard to a few of those claims.

As to the non-cyclic terpene recited in claim 12, the alleged successful use of a cyclic terpene as component (a) by Chen will say little or nothing about the suitability of a non-cyclic terpene as component (b). The cyclic structures in traction fluids are typically believed to be a factor in providing good traction properties, so there is no reason to believe that the non-cyclic terpenes would be particularly useful as component (b).

Regarding the use of a heteropolyacid catalyst as in claim 24, the Examiner has referred to U.S. Patent 6,346,585, Johnson, as a secondary reference. Johnson discloses preparation of high vinylidene isobutylene using a heteropolyacid catalyst. Aromatic materials may be included, but preferably the olefins employed are free from aromatic components (col. 7 lines 1-7). The only specific disclosure appears to be that of a polymer of isobutene with 5 wt. % styrene (col. 7 line 47), which is, incidentally, well below the minimum 10 percent by weight of component (a) as set forth in claim 13. Moreover, the molecular weight of the polymer prepared by Johnson is about 500 to about 5000 (claim 1). In contrast, the typical adducts of the present invention are low molecular weight mixed dimers and trimers (see examples). One would not look to the Johnson patent to obtain the materials of the present invention.

With regard to new claim 25, there is no disclosure in the references that the catalyst for the reaction should be a Lewis acid or a sulfonated crosslinked polystyrene resin.

With respect to new claim 26, there is no disclosure or suggestion in the references that the reaction product should be prepared from a vinyl arene which comprises a naphthalene nucleus.

Conclusion.

For the foregoing reasons it is submitted that the present claims are novel, unobvious, and in condition for allowance. The foregoing remarks are believed to be a full and complete response to the outstanding office action. Therefore an early and favorable reconsideration is respectfully requested. If the Examiner believes that only minor issues remain to be resolved, a telephone call to the Undersigned is suggested.

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Any required fees or any deficiency or overpayment in fees should be charged or credited to deposit account 12-2275 (The Lubrizol Corporation).

Respectfully submitted,

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